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Treatment of Urinary Incontinence

Martin Steidl
University of North Dakota

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TREATMENT OF URINARY INCONTINENCE

by

Martin Steidl
Bachelor of Science in Physical Therapy
University of North Dakota, 1998

An Independent Study

Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Master of Physical Therapy


Grand Forks, North Dakota
May
1999



This Independent Study, submitted by Martin Steidl in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.


(Faculty Preceptor)


(Graduate School Advisor)


(Chairperson, Physical Therapy)

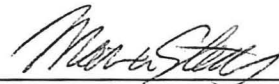
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ABSTRACT

Urinary incontinence (UI) is a significant medical issue to many people. The exact number of those suffering from incontinence is hard to quantify due to the stigma that many with UI experience and the subsequent under reporting of the condition. What is known is that UI affects far more women than men, and that stress incontinence (SI) is the most prevalent type. There are many reasons for the predominance of SI. The primary reason is the physiological and anatomical changes associated with menopause and parity in women. UI can be treated with one of three methods: surgery, pharmacologic therapy, and behavioral therapy. The behavioral therapy, in the form of Kegel's exercises performed in conjunction with biofeedback, has been shown to be an effective and inexpensive treatment option for mild to moderate cases of SI. The purpose of this paper is to illustrate the benefits of Kegel's exercises and biofeedback in terms of economics and in preventing the need for more invasive and costly treatments in UI.

CHAPTER I

INTRODUCTION

The mere mention of the term incontinent no doubt conjures up a myriad of unappealing thoughts and scenarios to those who hear it. For those who have been employed in nursing homes or have worked with people who suffer from incontinence, the unpleasant thoughts may be especially vivid. The word incontinent, when broken down into its Latin roots, is benign enough. *Continere* in Latin means to keep in or confine, while the prefix *in* means not.¹ Therefore, in keeping with the root definition, incontinent means to not confine or to not hold in. Incontinence today has generally been defined as a lack of ability to retain urine or feces.²

While not discounting in any way the importance and ramifications of fecal incontinence as a medical and social issue to many individuals, the focus of this paper is on the problem of urinary incontinence. Urinary incontinence (UI) is the loss of bladder control that results in uncontrolled leakage of urine.³ The amount of urine expelled ranges from a few drops at one end of the spectrum to a relatively heavy flow at the other. There are several types of urinary incontinence. The exact causal factors behind the inability to control or stop urine flow are many and vary considerably. The etiology is specific to the certain

type of UI of which the patient exhibits symptoms. The various types of UI, as well as some symptoms of each, will be explored later.

In the United States today, UI is a problem of major significance. It is estimated that greater than 13 million Americans suffer from one form of incontinence.³⁻⁵ While 13 million is an astronomical number, that estimation may be low for a variety of reasons. First of all, incontinence is severely under reported because of the embarrassment and shame that typically accompany the condition.⁴ Incontinent individuals feel stigmatized because they image their condition to be apparent to others and that, therefore, other people regard them with disdain. Therefore, whether the condescending attitudes of others is real or simply perceived, the sense of embarrassment a person feels with UI is very real. Due to these feelings of shame and inadequacy, less than one-half of the women with UI seek treatment.⁶ Secondly, in an attitude of stoicism, many people simply resolve to silently endure their condition. As a result, they often wait until the problem becomes either unbearable or significantly worse before they seek help. Interestingly enough, there is a very large time gap between genders in terms of when men and women seek treatment for incontinence. Men seek treatment, on the average, at a year and a half after symptoms begin, while women tend to wait three and a half years.⁷ Finally, UI appears to be under diagnosed by physicians.⁴ Whether through a lack of adequate training, or more possibly a failure to establish a comfortable relationship through adequate communication, the condition often goes unnoticed. For the above reasons, the actual number of people suffering from one of the several forms of incontinence

may dwarf the 13 million estimation. One source estimates that approximately 20 million Americans suffer from one form of incontinence.⁷ Even in the US, with a population greater than 250 million people, 20 million comprises an alarming percentage of the population.

While UI can and does appear at any age, the highest prevalence of incontinence appears in the elderly in both community and institutional settings.⁸ An ominous fact on the horizon is the graying of the Baby Boomer generation. The Baby Boomer generation refers to the 77 million Americans born between 1946 and 1964.⁹ As this large group of Americans gets older, the prevalence of incontinence will dramatically increase. In the present year of 1998, the current age range of the Boomers is approximately 34 to 52 years old. Of the current population over 60 years old, estimates are that anywhere from 15% to 35% have some form of UI.^{8,10} The oldest of the Boomers, at approximately 52 years old, are rapidly approaching 60 years old. Applying even the low percentage of 15% of individuals currently afflicted with UI to this rapidly aging group of Americans, it is clear that within a few years UI will become an even more serious problem.

In the coming years, as more and more people begin to suffer from UI, some of the more severe cases may need special care. The place where individuals receive this special care in increasing numbers is in long-term care facilities. As people age and incontinent episodes become more frequent or severe, they often rely on family members to help take care of them. The strain of having to constantly change sheets and wash clothes often times is too much

for caregivers, and the only place to turn is a nursing home. Among residents of nursing homes, the prevalence of UI is 50% or higher.^{4,8} Again, as a larger percentage of the population ages and develops complications of UI, the number of nursing home residents with UI will most certainly dwarf 50%.

Even more impressive than the number of people who have one form of UI is the substantial amount of money spent on the condition annually. Strange⁴ reports that Americans spent as much as \$27.8 billion on UI in 1995. Perhaps a more conservative estimate, but not any less shocking, is the \$11.2 billion spent in the community and the \$5.2 billion spent in nursing homes in 1994.⁸ While the cost in dollars is hard to pinpoint, the point is that clearly a substantial amount of money is spent annually by individuals desperate to treat their condition.

While medical treatment for UI is very expensive, conservative management is not inexpensive. The average person with UI spends approximately \$3,941 on various absorbent pads, deodorants, and skin care products.⁴ Overall, roughly \$1 billion is spent annually on incontinence pads and appliances.¹¹ Clearly, substantial amounts of money are spent each and every year by individuals to cope with the symptoms of UI. What is especially problematic is the fact that in our society many of the elderly, the group of people who most commonly suffer from UI, live on fixed incomes. Living on a tight budget with Social Security makes it difficult to absorb the constant cost of treating UI with pads and appliances. Clearly, while UI is an embarrassing problem, it is also a very expensive one.

While the economic cost in terms of dollars and cents spent annually on UI is enormous, it pales in comparison to the social and psychological strains that individuals endure. UI has a very devastating effect on the loss of a social life as well as the psychological composition of the person afflicted. Often people with UI feel imprisoned by their condition in terms of not having the freedom to go where they wish. Individuals often limit their social excursions to places where they implicitly know the location of every toilet and bathroom.¹² The fear and anxiety involved in going someplace new coupled with the possibility of an accident occurring can be very extreme and socially constrictive. As a result of the anxiety such a situation creates, sufferers may limit or eliminate their social excursions and, as a result, experience a loss of independence. The decrease in social mobility and the resulting loss of independence results in a marked decrease in self esteem.⁸

The loss of social interaction has devastating psychological effects. Breakwell et al¹³ report that incontinent home-bound women experience significantly fewer social interactions when compared to continent women. Since humans were not meant to live in a shell, the severing of ties from friends and family often leads to depression. Incontinent women exhibit much higher levels of depression when compared to continent women.¹³ The severity of the incontinence appears to have a linear relationship to the level of depression.

Urinary incontinence is an enigma in that it is a major medical concern even though people do not die from it.⁴ Incontinence is a very wide ranging problem that afflicts a great many people in the US. The repercussions of UI

range from over reliance on nursing homes for care to the almost obscene amounts of money spent on various methods of treatment. On a personal level, those afflicted often times find themselves stigmatized by the condition and either completely cut out or severely limit their social interactions. As a result, the true number of people with UI, and the cost in terms of economics and psychological wellness, may never be known.

The purpose of this paper is to describe the effects of urinary incontinence, who is primarily affected, the anatomy of the genitourinary system involved with continence, the various types and causes of incontinence, and treatment methods available. The focus of this paper is on a specific type of urinary incontinence, stress incontinence, which will be described in a subsequent chapter.

CHAPTER II

GENDER

While it may be hard to guestimate the exact number of people who suffer from incontinence due to the aforementioned sociocultural factors, such as perceived stigma and stoicism, data do exist that illustrate a clear demarcation of the incidence of UI between men and women. Men and women are not equally affected. As high as 75% of those who have reported suffering from UI are women.¹⁴ Another source estimates that as many as 85% of the individuals with UI are women.⁵

Currently in the United States, women are two times more likely than men to suffer from incontinence.¹⁰ However, such a discrepancy between the number of men versus the number of women affected is not observed in just the US. A study by Schuman et al¹⁵ in Belgium reports results that illustrate a significant difference in prevalence between men and women. Out of a sample of 5269 respondents to a questionnaire, 2499 men and 2700 women, 5.2% of the men and 16.3% of the women reported problems with continence. While the ratio of this study is higher than the two-to-one ratio reported earlier, it is illustrative of the fact that women are generally more prone to develop UI than men.

While women have many different mechanisms for developing UI, most of the cases of incontinence arise from one cause in men. The main cause for the

development of UI in men is from a prostatectomy.⁷ The surgical solution to prostate cancer can have a negative side effect, as approximately 120,000 men develop incontinence post surgically.¹⁴ As mentioned previously, with women, the causal factors are much more diverse, depending upon the type of incontinence, and will be elaborated on in a later chapter. However, two common causal factors are childbirth and menopause.¹⁶

While UI can and does appear at any age and is by no means relegated to the elderly, the incidence of incontinence increases with advancing age. Since it has already been established that UI affects women more than men and incidence increases with age, it is logical to assume that as women get older, the incidence of incontinence among them increases. Approximately 15% of 40-year-old women and 30% of women greater than 50 years old report regular leakage.¹⁴ Lipsitz and Snyder¹¹ report that women in their 60s have a 30% incidence of incontinence, both in the institutionalized and in the noninstitutionalized settings. Of the women above the age of 60, one out of three have some degree of UI.⁶ Slightly less grim, but nonetheless alarming, are the findings of a study by Schuman et al¹⁵ that report 21% of women over 50 years old exhibit some degree of incontinence. The evidence clearly supports the theory that as women age, the incidence of incontinence increases among them.

The cost in terms of emotional and physical discomfort for women with UI often times can be the aspect most difficult with which to come to terms. Incontinent women who are either occasionally or constantly wet must endure

various rashes, skin infections, pressure sores, and the occasional urinary tract infection, just to name a few inconveniences.^{4,10}

Women often noticeably modify their behavior in order to cope with the condition. In an effort to alleviate the constant wetness, many women simply reduce their fluid intake. The logic on the surface appears to be sound, but reducing fluid intake has a definite negative effect. With decreased fluid intake, the urine becomes much more concentrated and, therefore, even more irritating to the skin.⁶ Also, some women tend to constantly check for signs of leakage on clothing and apply heavy doses of perfume in an attempt to cover up any odor, real or imagined.¹² These activities, though designed to cover up their incontinence, often have the opposite effect. Any out-of-the-ordinary behaviors often draw attention to these women which, of course, results in increased embarrassment. A survey by Diokno et al¹² found that 57% of incontinent women felt that their urine loss problem was very embarrassing and 31% found the problem to be somewhat embarrassing. Therefore, 88% of the women in this survey were not at ease with their condition.

The stigma women feel over their incontinent status often prevents them from experiencing activities they previously enjoyed. The embarrassment can become so insurmountable that it often curtails sexual activity.¹² The loss of what still can be pleasurable in conjunction with the embarrassment they feel has an immeasurable negative effect on the quality of life for women with UI.

CHAPTER III

ANATOMY

Further discussion of urinary incontinence requires a basic understanding of the anatomic structures that comprise the support mechanism of the urinary system. The anatomy of the urinary system is very complex. The complexity level increases considerably when the synergistic effect of the systems at work is considered. The pelvis, pelvic floor musculature, and endopelvic fascia provide support for pelvic organs.¹⁷ The three systems, when all functioning properly, produce continence.

The pelvis, pelvic floor musculature, and endopelvic fascia collectively comprise the continence mechanism. The continence mechanism is a term for the organs and support structures that facilitate and maintain continence. Without adequate support, problems with maintaining continence can and often do develop, as will be discussed in the next chapter. Due to the vital role the support structures play, they will each be discussed at length. The support systems that will be described are the pelvis, the musculoskeletal system, the ligamentous support, and, finally, the urethra and bladder. However, due to the extreme complexity of all of the systems, the discussion is primarily limited to gross anatomy, along with an explanation of function as needed. The intent is to

establish the importance of the synergy of these systems when healthy and how a fault in one or more of them can lead to the development of UI.

Pelvis

A house built on a solid foundation will generally stand the test of time. The bony pelvis serves as the strong foundation upon which support for the pelvic organs is built. The pelvis is the general term for the area of the body where the trunk meets the legs. The bony structure of the pelvis is formed by the two innominate bones anteriorly and laterally, and the sacrum and coccyx posteriorly.¹⁸ The innominates themselves are comprised of the ilium, ischium, and pubis. These three sections are fused together and present as one bone. The ilium is wing-shaped and forms the superior portion of the innominate; the ischium is the short posteroinferior section, and the pubis forms the anterior inferior portion of the innominate.¹⁸ The two innominates are joined anteriorly at the pubic symphysis. The sacrum and coccyx close out the pelvis posteriorly.

The area enclosed by the bony ring consisting of symphysis pubis anteriorly, innominates laterally, and sacrum and coccyx posteriorly is known as the pelvic cavity. The pelvic cavity encases the pelvic organs, many of which will be discussed later. The pelvic cavity is bound inferiorly by a layer of muscle known as the pelvic floor, or pelvic diaphragm.¹⁹ The pelvic cavity funnels downward toward the inferior aperture which functions as a scaffolding for the pelvic floor. Numerous ridges and tuberosities are present on the walls of the pelvic cavity. These imperfections in the bone provide attachment sights for the various musculature and ligaments that support the pelvic organs.²⁰ The pelvic

floor is the layer of musculature that supports the organs and structures within the pelvic cavity.

The pelvis can be divided into a pelvis major (false pelvis) and a pelvis minor (true or obstetric pelvis).¹⁹ The distinction between the two is important in the study of UI. The pelvis major is considered to be a part of the abdominal cavity and is located above the pelvic brim. The pelvis minor lies below the pelvic brim. The inlet of the pelvis minor is bound by the sacral promontory posteriorly, the pubic symphysis anteriorly, and the terminal lines (pectineal, arcuate) laterally.¹⁸ The pelvis minor is more important to the discussion of UI and, as the alternate name obstetric pelvis implies, is associated with the birth canal. The outlet of the pelvis minor is formed by, anterior to posterior, the pubic arch, inferior rami of the pubic, ischial tuberosities and spines, and the sacrum and coccyx.¹⁸ The cavity of the true pelvis that lies between the inlet and the outlet houses the pelvic organs integral to continence, such as the bladder and urethra. Stretched like a hammock or swing across the inferior pelvic aperture (outlet) and enclosing the pelvic cavity from below is the pelvic diaphragm.

A key issue involving the pelvis, and one that helps to explain the imbalance in the incidence of UI between men and women, is that there exists a difference in pelvic structure between the sexes. The female pelvis is generally wider and shallower than that of a male. The difference in width usually presents itself as wider hips on the female. The wider pelvis is designed to allow the female to carry and deliver a child. Concurrently, the female pelvis has wider superior and inferior apertures to allow for passage of the child. The ischial

spines, sacrum, and coccyx do not project toward the center of the pelvis as they do in the male, which further widens the inferior aperture.¹⁸

Anthropologists have defined four variations of the bony pelvis. Two of the four are more commonly present in males, whereas the other two are predominantly female variations. The anthropoid and platypelloid variations are common in males.¹⁹ The anthropoid pelvis has a short transverse diameter with a long anteroposterior diameter, while the platypelloid has a long transverse and short anteroposterior diameter.¹⁸ The android and gynecoid variations are found primarily in females.¹⁹ The android pelvis is found in 28% of women and is funnel shaped with a contracted pelvic outlet.²¹ The gynecoid pelvis is the most commonly found pelvis in women.²⁰ An estimated 44% of women have the gynecoid variation.²¹ The gynecoid pelvis is by far the largest pelvis in terms of transverse diameter. The transverse diameter is measured from the linea terminalis on one side to the linea terminalis on the other, while the anteroposterior diameter is measured from the pubic symphysis to the sacral promontory.¹⁹ The gynecoid pelvis has obstetric significance due to its large dimensions. The enlarged area inside the pelvis as well as the larger superior and inferior apertures are ideal for bearing children. However, due to the larger inferior aperture, the gynecoid pelvis predisposes women to develop stress incontinence.²⁰

Musculature

The supportive musculature of the urinary system is complex. As mentioned previously, the pelvic diaphragm encloses the pelvic cavity inferiorly.

The obturator internus muscle has an important relationship to the pelvic diaphragm in that it serves as an intermediary for the pelvic diaphragm to attach to the pelvis. The obturator internus muscle runs from the pelvis, through the lesser sciatic foramen, and attaches to the greater trochanter of the femur.¹⁹ The muscle also covers the lateral walls of the internal pelvis. The obturator internus fascia, known as the tendinous arc, crosses the medial aspect of the muscle between the pubic bone and ischial spines bilaterally.²⁰ The tendinous arc of the obturator internus flanks the proximal urethra anteriorly and the rectum posteriorly as well as serves as a lateral attachment for the ligaments and muscles of the pelvic floor.²⁰

The endopelvic fascia is a continuation of the abdominal transverse fascia, and it attaches to and joins the pelvic organs.¹⁹ The endopelvic fascia forms fascial sheaths for support of the vessels and nerves that run through the pelvis.²² The fascia varies in thickness, depending upon the level of stress encountered with various structures. Where greater support is required, the fascia condenses into thick bands, forming the vesicouterine, cardinal, and uterosacral ligaments.²² Therefore, the pelvic fascia serves as an integral step in the support hierarchy of the pelvic organs and structures. The various ligaments, endopelvic fascia condensations, and their functions will be discussed shortly.

The urogenital diaphragm closes the genital hiatus between the ischiopubic rami, thus comprising the anterior portion of the pelvic floor.²⁰ The urogenital diaphragm effectively fills the pelvic floor gap between the anterior levator ani muscles, the next and perhaps most important component of the

pelvic floor. Through this anterior portion of the pelvic floor pass the urethra, vagina, and rectum.²³ The fact that these structures pass through the urogenital diaphragm will be significant when the discussion turns to the various causes of UI.

The pelvic diaphragm that encloses the pelvic outlet is primarily composed of the levator ani and coccygeus muscles.^{19,20} The pelvic diaphragm can be divided into an anterior pubovisceral portion and a posterior portion, known as the base plate.²⁴ The base plate consists of the posterior levator and the coccygeus muscles. The base plate is a more solid structure in terms of durability and has no relationship to UI. Therefore, the division is based primarily on function.

As stated previously, the levator ani comprises the most functionally important segment of the pelvic floor. The levator ani is responsible for supporting the bladder and urethra in their intraabdominal positions.²⁵ When the abdominal muscles contract during a strenuous activity, such as lifting, laughing, or even coughing, the levator ani reflexively contracts.²⁰ The reflexive contraction of the levator ani compresses the vagina, anal canal, and urethra toward the pubic symphysis.¹⁷ A strong and healthy levator ani will match the increasing intraabdominal pressure forcing the pelvic organs inferiorly with stronger contractions. Therefore, the levator ani eliminates any urethral opening at the time of strain, an integral aspect in continence.¹⁷

The levator ani, often idealized as a hammock of the pelvic floor, is a very large muscle. The levator runs on an inclined plane, sloping up from the

posterior pubic, providing a shelf on which the pelvic organs lie.²⁶ The levator is also a fairly strong muscle as the inclined shelf must support the weight of the abdominopelvic organs and manage any increases in intraabdominal pressure. The strength of the levator is compromised somewhat by the fact that it is not a solid sheet of muscle. The levator is pierced by the urethra, vagina, and rectum superiorly to inferiorly.

An important aspect in the function of the levator ani is the composition of the muscle. Slow twitch fibers (type I) which maintain tone constitute 70% of the muscle, while fast twitch (type II) comprise the remaining 30%.¹⁷ The composition of the levator ani will have clinical importance when various treatment methods are utilized. The slow twitch fibers are responsible for the maintenance of the baseline tone of the pelvic floor that compresses the urethra and vagina while at rest. The fast twitch fibers are active in the reflexive contractions that respond to sudden increases in intraabdominal pressure.¹⁷

The levator ani is composed of three muscles: the pubococcygeus, ischiococcygeus, and the puborectalis.²⁰ The pubovisceral portion of the levator ani, more specifically the pubococcygeus muscle, appears to have the most intimate relationship with the maintenance of continence. The pubococcygeus muscle directly attaches to the bladder, vagina, uterus, urethra, and rectum.²⁰ Since the pubococcygeus muscle is more directly involved with the continence mechanism, the ischiococcygeus and the puborectalis portions of the levator ani will not be discussed. The pubococcygeus portion of the levator ani originates from the pubic bone and the anterior tendinous arc of the obturator internus

muscle.²² The urethra, vagina, and rectum all travel through the pubococcygeus muscle. Due to the role as a support mechanism, the pubococcygeus portion of the levator ani must remain healthy and be able to optimally contract to meet any rise in intraabdominal pressure to prevent incontinence.

Ligamentous Support

There are numerous structures that aid the pelvic musculature in support of the pelvic organs. The organ of most importance in terms of a need for strong ligamentous support is the urethra. The most common cause of stress incontinence is urethral hypermobility.⁸ Therefore, it is of utmost importance that the ligaments of support for the urethra are sound. As previously stated, these support ligaments are dense condensations of the endopelvic fascia that join the pelvic organs and the pelvic floor. Among the various support ligaments are the cardinal, uterosacral, urethropelvic, and the pubourethral ligaments.²⁰ While these ligaments mentioned are all important support mechanisms, some of them are more intimately involved with the urethra.

The urethropelvic ligaments play a key role in maintaining continence.²⁰ The urethropelvic ligaments, along with the fibers of the pubococcygeus muscle, attach to the bladder neck and proximal urethra, providing the main support for this region of the urethra.¹⁷ The attachments of the ligaments and muscle fibers prevent the downward and outward mobility of the urethra.²² Proper support of the urethra requires both an active muscular contraction and a strong ligamentous component to resist forces during stress.

Perhaps even more critical to urethral stability are the pubourethral ligaments. These paired condensations of fascia anchor the midurethra to the posterior surface of the symphysis pubis.¹⁷ Of the two condensations, anterior and posterior, the main support comes from the posterior pubourethral ligament.²⁵ The pubourethral ligaments are well developed, containing both collagen and smooth muscle components.²⁴ In essence, these ligaments contain both a strong ligamentous component and a contractile component. Weakness in these ligaments permit posterior and inferior movement of the mid urethra into the potential space of the vagina.²⁰ The importance of the integrity of these ligaments is clear. Milley and Nichols²⁴ suggest that inadequacy of the pubourethral ligaments is one of the anatomical defects that contribute to urinary incontinence. Although these ligaments do not offer measurable support to the bladder neck, consensus remains that defects of the pubourethral ligaments lead to urinary incontinence.²⁰

The integrity of the ligaments supporting the urethra is very important in reference to maintaining continence. When the ligaments are lax, the urethra is allowed to move which leads to complications that will be discussed next.

Urethra and Bladder

Having spent the greater part of the chapter describing the support network of the urethra and bladder, it is now important to discuss their role in maintaining continence. The urethra and bladder will be the final anatomical structures discussed. The urethra and the bladder are essential components of

the urinary system. The maintenance of a working relationship between them is essential to continence.

The urinary system can be divided into two segments, the upper and the lower urinary tract. The upper urinary tract is composed of the kidneys and the ureters. The function of the kidneys, overly simplified, is to filter and collect urine. The urine is then transferred via the ureters, acting as drainpipes, to the bladder. The lower urinary tract is comprised of the bladder and urethra. Urine is stored in the bladder and expelled from the body via the urethra. The lower urinary tract is clinically significant in the study of UI.

The urinary bladder is located in the anterior pelvic cavity just superior and posterior to the pubic bone.²² There are certain anatomical aspects of the urinary bladder that must be mentioned. The bladder has an apex or superior surface, a base or posterior surface, and a neck.¹⁸ The inferior lateral surfaces are in contact with the levator ani and the obturator internus muscles.²² These muscles, therefore, support the bladder, providing a shelf on which it rests. The neck of the bladder is the most inferior part of the bladder.¹⁸ The smooth muscle component of the bladder is known as the detrusor muscle.²⁷

The urethra runs inferiorly and anteriorly from the neck of the bladder, through the urogenital diaphragm, and exits at the vestibule, or exterior opening located anterior to the vagina.¹⁸ In the adult female, the urethra is approximately four centimeters in length.²⁰ The urethra can be functionally divided into the initial, midurethral, and distal urethral segments. The bladder neck and proximal urethra are considered the initial segment.²⁵ The initial segment of the urethra

extends from the outlet of the bladder to where the urethra passes inferior to the pubic bone. While the initial segment only represents approximately 20% of the total urethral length, this segment and stability of it has a great influence on continence.²⁰ The midurethral and distal urethral segments collectively run from the pubic bone through the urogenital diaphragm. The urethra terminates at the external urethral meatus, the exterior aperture of the urethra.²⁸

As the urethra approaches the bladder, its muscle fibers mesh with the fibers of the trigone muscle that partially surrounds the bladder.²⁸ The urethral junction is known as the bladder neck, and the proper support of this structure is essential to continence. When in a standing position, the bladder is held in a horizontal position above the level of the symphysis pubis.²⁵ The bladder neck appears as a kink as the urethra enters the bladder. The angle at which the urethra enters the trigone muscle, the urethrotrigonal angle or the urethrovesicular angle, is less than 100°.²⁵

Continence Mechanism

The anatomy of the urethra and bladder has been superficially explained. However, the relationship between the urinary bladder, urethra, and support mechanisms responsible for maintaining continence is very complex. In order to maintain continence, the urethra must be secure (as opposed to hypermobile) and urethral pressure must be greater than the bladder pressure.²⁹

Intraurethral resistance is maintained by a number of mechanisms; the position of the urethra through the pelvic floor, the angle of the urethra to the bladder, and the position of the urethra as a non-mobile structure.²⁹ Normally,

the bladder base is located inferior to the entrance of the urethra. Therefore, in order for urine to flow from the inferior bladder base to and through the more superior urethra, the pressure would have to be much greater in the bladder than in the urethra.²⁹ The angle of the kink of the urethra as it meshes with the trigone (less than 100°) and the position of the bladder base thus combine to preserve continence in that they serve to keep the urethral pressure greater than that in the bladder at rest. The urethral kink is referred to as the first level of continence.²⁵

During normal straining not associated with micturation, the levator ani muscles and the urethral support ligaments work to maintain the bladder base position and the integrity of the urethral kink even as the bladder descends approximately 1.5 cm.²⁵ The preservation of the relationship of the urethra to the bladder during an increase in intraabdominal force allows for equal pressure transmission to the urethra and the bladder. Therefore, even though the intrapelvic position of the bladder and urethra change in a vertical fashion, the pressure concentrations remain the same. The result is the preservation of the higher intraurethral pressure (higher than the bladder) and the integrity of continence.

However, the continence mechanism does not function as efficiently in people with UI. The first cause of UI to be discussed is the hypermobile urethra. Earlier, it was stated that the initial segment of the urethra (first 20%) was crucial to the maintenance of continence. The various reasons for the weakening of the support structures of this initial segment will be discussed in the next chapter. If

the support structures are weakened, the proximal segment of the urethra will tend to be mobile with any increase in intraabdominal pressure. The mobile urethra will then result in a change of the urethrotrigonal (urethrovesical) angle. Urethral sphincter function depends on the maintenance of an acute urethrovesical angle.²⁷ The urethral sphincter is not an anatomical structure per se; rather, it is a functional one formed as the urethra enters the trigone.²⁰ To maintain continence, the pressure in the urethra must exceed that in the bladder while at rest. With the changing angle of the urethra to the bladder, less pressure is required to overcome urethral resistance, leading to incontinence. If the urethra is excessively hypermobile, it migrates in a posterior inferior direction into the potential space of the vagina. In this case, intraabdominal pressure now is received more directly by the bladder than the urethra and overcomes urethral resistance.²⁹

There are other mechanisms besides the urethrotrigonal angle that maintain a high intraurethral pressure. Coaptation of the urethral mucosa is important to continence.²⁷ The thick, highly vascular submucosa of the proximal urethra contributes coaptation and a mucosal seal, thus increasing the intraluminal pressure of the urethra.²⁰ The next chapter will discuss some of the age associated causes of the breakdown of this mechanism.

The action of the levator ani muscles also helps to increase intraluminal pressure of the urethra. In response to a lifting or forceful activity that creates a rise in intraabdominal pressure, the pelvic diaphragm reflexively contracts.¹⁷ The result of this reflexive contraction is the compression of the urethra, vagina, and

rectum toward the symphysis pubis. A strong, healthy levator ani will contract with enough force to effectively close off the urethra. The closing off of the urethra increases the intraluminal force that must be overcome, and continence is maintained. Conversely, a weakened levator ani would not be able to contract as hard, thus would not be able to efficiently close off the urethra. Therefore, the intraurethral pressure would be less difficult to overcome. However, it is clear that the healthy pelvic floor plays an integral role by not only supporting the bladder in response to a rise in intraabdominal pressure, but by also providing an additional occlusive force on the urethra.²⁸

An efficient urinary continence mechanism requires an intact urethra that receives proper anatomical support.²⁵ The anatomic support is provided by the pelvis, pelvic diaphragm, and ligaments. Due to the complexity of the relationship of these structures, many aspects of that relationship were quickly covered. The importance of how these structures must work together and function properly in order for continence to be maintained was defined. In the individual with UI, one or more of these components are unable to function properly. The next chapter focuses on the types of incontinence, particularly stress incontinence, and the etiological factors behind the disruption of the continence mechanism described in this chapter.

CHAPTER IV

TYPES OF URINARY INCONTINENCE

A general knowledge of the anatomy of the pelvic area should serve to facilitate a better comprehension of urinary incontinence when that knowledge is applied to the types and causes of UI. It is important to gain marginal insight into the varying types of incontinence that affect an estimated 13 million Americans. To lump all 13 million people under the umbrella of the term incontinent would be both overly simplistic and woefully inaccurate. The inaccuracy of generalizing the condition would be accentuated by the fact that the general term incontinent relays no information about the etiology of the specific type of incontinence with which the individual presents.

A wide variety of subclassifications of urinary incontinence exist. Each subclassification is distinguishable by the underlying pathology of the incontinence as well as the presentation of symptoms. Therefore, it is clinically important in terms of management and treatment to classify or group individuals into the various categories of incontinence. Most clinicians classify urinary incontinence on the basis of the patient's clinical symptoms.³⁰ The classification of individuals is in no way meant to counter the current trend of person-first terminology. Rather, it is meant to be more of a diagnostic classification that lends itself to explanation of the various types of incontinence.

There are numerous types of UI that have been clinically defined. However, for ease of discussion in this forum, only the most prevalent will be described. The four most common subclassifications of UI are urge, overflow, mixed, and stress incontinence.³⁰ Stress incontinence (SI), by far the most common type and the general focus of this paper, accounts for approximately 75% of incontinence cases among women.⁵ However, it is important to discuss, albeit briefly, urge, overflow, and mixed incontinence. Knowledge of the other prominent types of UI is essential to further distinguish SI as a separate entity with separate etiology and treatments.

Urge Incontinence

Urge incontinence is defined as the involuntary loss of urine preceded by an urgent desire to void.³ Urge incontinence is second only to stress incontinence in terms of prevalence. Symptoms may occur during the day or at night.³⁰ Urge incontinence is due to inappropriate detrusor, or bladder muscle, contractions.²⁷ The spontaneous contraction of the detrusor increases the bladder pressure above that of the urethra and results in an incontinent episode. The contractions are spontaneous and occur with little or no advanced warning, other than the desire to void immediately preceding the event. The complications in terms of restriction of social activity due to the fear of this event occurring are obvious. Urge incontinence occurs with similar frequency in both men and women.^{15,27}

There are two primary factors that have been identified as playing a role in the development of urge incontinence. Urge incontinence is caused by either the

aforementioned spontaneous detrusor contractions, known as detrusor instability, or by failure of cortical control mechanisms to inhibit reflex detrusor contractions, termed detrusor hyperactivity.³¹ Detrusor hyperactivity is commonly a result of neurologic lesions, as in the case of a stroke patient.^{8,32} Detrusor instability, on the other hand, has no known neurologic etiology.¹¹ Detrusor instability is a more common cause of urge incontinence than detrusor hyperactivity.³¹ Evidence suggests that certain substances, such as artificial sweeteners and caffeine, cause bladder irritation and, therefore, can play a slight role in the development of urge incontinence.^{7,10} The various treatments for urge incontinence include estrogen treatments, anticholinergics, or smooth muscle relaxants.²⁷

Overflow Incontinence

Overflow incontinence (OI) is defined as the involuntary loss of urine due to the incomplete emptying of the bladder.³⁰ In these cases, the bladder never completely empties and, as a result with pressure from the detrusor, small amounts of urine leak out. Hypertonicity of the detrusor muscle, commonly associated with a neurologic problem, is generally considered to be a cause behind OI.²⁷ The rigid detrusor prevents the bladder from expanding to accommodate any more urine. OI is commonly associated with diabetic patients.¹⁰ In association with a possible neuropathy of the bladder muscle which can prevent the bladder from fully contracting, there is residual urine. The hyperglycemic environment promotes rapid urine formation. While often present in older women, OI is more commonly associated with men where the outflow of

urine is obstructed by prostate hypertrophy.³⁰ Beta-adrenergic blockers may be helpful in alleviating the symptoms of OI.²⁷

Mixed Incontinence

Mixed incontinence is the co-existence of stress and urge incontinence.⁴ The patient will, therefore, present with features suggestive of both stress and urge incontinence.³⁰ However, one symptom (urge or stress) is more encumbering than the other. Discerning which symptom affects the patient to a greater degree is important in targeting therapeutic interventions.

Stress Incontinence

Stress incontinence (SI) is defined as an involuntary loss of urine that occurs with an increase in intraabdominal pressure without any evidence of a detrusor muscle contraction.³⁰ Any activity that significantly increases intraabdominal pressure results in an incontinent episode. As stated earlier, incontinence results when the bladder pressure exceeds the urethral closure pressure in response to increases in the intraabdominal pressure. Activities ranging from walking, standing from a seated position, jogging, coughing, and even laughing, can result in an incontinent episode.¹⁰ As SI generally results from activity, nocturnal symptoms are often minimal.

Stress incontinence is by far the most common form of incontinence among older women, afflicting 57% of all women between the ages of 45 to 64 years old. Pinkowish⁵ reports that as many as 11 million women in the US have SI. SI can affect women of all age groups. While SI is primarily present in multiparous women, it is prevalent, although far less common, in young

nulliparous women.⁸ However, it is important to distinguish SI in younger versus older women. Incidents of SI occur in younger women primarily during heavy physical activity. Nygaard³⁴ reports that two-thirds of gymnasts and basketball players reported symptoms of incontinence during activity, while only 10% of swimmers reported similar episodes. There is a clear correlation in the degree of strenuous activity and the presentation of incontinent episodes.

Incontinent episodes in younger women are primarily transitory, occurring only during periods of strenuous activity. This fact contrasts sharply with the presentation among older women. Many older women experience episodes of incontinence while performing daily activities. Coughing and laughing cannot be compared, in terms of intraabdominal pressure created, with playing basketball and engaging in heavy lifting. Therefore, there are clearly factors present in older women that predispose them to SI with even gentle activities.

Before discussing the internal changes present in older women that lead to SI, it is important to offer a brief example of a classification system currently in use. Snyder and Lipsitz¹¹ report that SI can be classified into four classifications of severity. These classifications are Types 0, I, II, and III. In Type 0, the patient has complaints of incontinence, but incontinence cannot be elicited on examination. In Type I, the patient presents with SI, but has minimal hypermobility of the bladder and urethra, which has already been stated to be the primary cause of SI. In Type II, more mobility of the bladder and urethra is evident with applied stress. In the last classification, Type III, leakage of urine

occurs even without provocation. These four classifications provide a reliable scale from which to gauge the severity of SI.

As alluded to previously, urethral hypermobility is a major cause of SI. The previous chapter discussed how important the integrity of several support structures is on maintaining continence. In order to facilitate understanding of SI, a short recap is in order. As the average woman lies supine, urethral pressures range from 40 to 80 cm H₂O, and during a stress maneuver (cough, laugh), pressure in the bladder and abdomen show increases of 20 to 100 cm H₂O.¹¹ There are three primary reasons why a “normal” woman remains continent. First, the reflex contraction of the pelvic floor increases the urethral pressure so that even the large increase in bladder pressure does not overcome the urethral closing pressure. Secondly, the normal urethra is well supported by the various support structures discussed previously. An increase in abdominal pressure is transmitted evenly to the bladder, bladder neck, and urethra, maintaining the pressure gradient that facilitates the presence of urine in the bladder. Third, the well supported bladder neck is superior to the bladder base. Therefore, most of the pressure is “felt” at the inferior bladder base, not the bladder neck.

As the bladder neck loses support, the urethra migrates in an inferior and posterior direction into the potential space of the vagina.³⁰ The change in position of the urethra offsets the delicate balance needed for continence. When the urethral vesicle angle changes, pressure is not evenly distributed and the result is incontinence.³⁰ Thus, displacement of the urethra and bladder neck

(hypermobility) causes urethral sphincter deficiency.⁸ There are many reasons why the continence mechanism fails in elderly women. Mold²⁷ states that pelvic floor laxity is a result of age associated loss of muscle strength and traumatic injuries, for example, childbirth. Hadley et al²⁵ elaborate by stating that weakness of pelvic supports is caused by, among other things, menopause and multiparity. These factors will be discussed briefly.

Menopause occurs at an average age of 50 to 51 years old.³⁶ Many physiologic changes are associated with menopause; however, one certain change is a contributing factor to the development of SI. Menopause, either surgical or natural, results in decreased or diminished circulating estrogen that can affect the genitourinary system causing atrophic changes.¹⁶ The correlation between the onset of symptoms of SI and the onset of menopause illustrates how important estrogen is to the genitourinary system. Estrogen keeps urinary tissues and muscles in top shape.³⁵ There are estrogen receptors found throughout the urethra, trigone, and bladder muscles.²⁷ Maloney¹⁶ reports that the lower urinary tract muscles are very hormonally sensitive. Loss of estrogen causes the urinary and vaginal tissues as well as the pelvic musculature to lose their tone, and thus some of their ability to support pelvic organs.³⁵ Estrogen deficiency also cause atrophy of the epithelial lining of the urethra.²⁷ The presence of estrogen widens the umen (urethral sponge) fourfold which contributes as much as 30% to the urethral closing pressure.²⁵ The urethral sponge, in the presence of estrogen, forms a secure structure around the urethra that serves to support and hold the urethra in place. As this structure atrophies,

the urethra is allowed to move. The resulting loss of coaptation of the urethral mucosa reduces the intraurethral closing pressure.

Pregnancy, specifically changes in the pelvic floor associated with parity, is a major cause of pelvic floor laxity that leads to SI. Nygaard³⁴ states that parity is a major risk factor for pelvic floor dysfunction. Perlmutter³⁶ reports that one-third of the women who deliver vaginally develop stress incontinence. It is simple to understand how the trauma of vaginal birth affects the integrity of the pelvic floor. The urethra, vagina, and rectum pass vertically through the anterior pelvic floor musculature. As the head of the baby proceeds through the lower birth canal, the small gap in the anterior pelvic diaphragm enlarges enormously. The extreme stretch associated with birth can damage nerves, compromise connective tissue and ligaments, and weaken musculature.³⁶ After the fetus passes through the birth canal, the levator ani recoils and takes up its previous position. Over time, as logic would dictate, with multiple births, the pelvic muscles as well as the ligaments lose some of their ability to recoil. Therefore, support of the continence mechanism is diminished in two ways. The pelvic musculature can no longer adequately support the organs in response to an increase in abdominal pressure or provide adequate occlusion to the urethra in response to an increase in abdominal pressure.

Of the four most prominent types of UI, stress incontinence is the most pronounced, especially in elderly women due to an accumulation of factors that occur over time. The symptoms of SI are caused by a breakdown in the support of the bladder and urethra. The breakdown occurs via a variety of mechanisms,

two of them being estrogen deficiency and, more significantly, the process of giving birth. The pelvic floor musculature will progressively weaken if no interventions are attempted to strengthen it.

CHAPTER V

TREATMENTS

The focus of this chapter is on the variety of treatment options available for stress incontinence (SI). It is estimated that up to 85% of SI can be cured or managed.³³ The method of treatment chosen depends upon a variety of factors, most specifically, the severity of the incontinence. The three main treatment arenas are behavioral techniques, pharmacological interventions, and surgery.¹⁰ These treatment options run the spectrum from mild to moderate SI (behavioral, pharmacological) to treatment of severe SI (surgical interventions). The treatment techniques will be expanded upon in reverse order, beginning with a brief overview of some of the various surgical techniques so that more attention will be placed on the behavioral realm of treatment.

Surgical

Surgical intervention for SI is generally considered a last resort. Surgery is indicated when symptoms of SI, specifically uncontrolled leakage, have failed to respond to previously attempted conservative measures.³⁰ Surgical procedures may be indicated as initial therapy if the symptoms of SI are severe.³⁷ Yet another indication for surgery is if the symptoms are chronic, as there is no need for surgical treatment in the management of transient

incontinence.³⁸ Transient incontinence, as the name implies, comes and goes, usually with heavy activity, and can be treated with other measures.

There have been over 100 different surgical techniques that have been described for the treatment of SI.³⁹ The variation is due, in part, to different approaches to correcting the problem or improvements on earlier procedures. The goal of surgery is to correct anatomical defects that cause incontinence.³⁸ More specifically, the intent of the surgical intervention is to reconstruct the vesicourethral angle via various techniques and stabilize it in its functional position.³⁹ The last chapter defined the vital role that a nonmobile urethra plays in maintaining equal pressure distribution and, therefore, continence.

An adequate evaluation of the patient considered for surgery is key to a successful surgical repair.³⁹ As previously mentioned, surgery is the primary treatment for severe, chronic SI; therefore, in order for patients to be candidates, they must present with those symptoms. However, there are also other factors that affect the success of a surgical procedure. Berglund et al⁴⁰ report that variables such as the age of the patient, duration of SI symptoms, psychological factors, and the personality of the patient all affect the results of the surgery. Certain psychological factors, specifically how the patient feels about surgery, play a large role in the successful outcome of the surgery. The mental status of the patient determines success because it affects the decision on the type of surgery to have and, as will soon be discussed, different surgeries have different success rates. If a certain surgical procedure is of short duration and has a lower risk of morbidity (short-term), a patient may elect for this procedure even if

it is associated with a lower long-term cure rate.³⁷ The patient may decide to chose surgery A over a procedure B that has a longer duration and a higher risk of complications, even if intervention B is associated with a higher long-term cure rate. Conversely, the opposite is true as some patients may elect to go with procedure B because of the long-term effects. Therefore, individual variation definitely has a role in the selection of a procedure and, therefore, the success in curing their incontinence. Berglund et al⁴⁰ report the three most important predictors of surgical outcome as the duration of SI, neuroticism of the patient in terms of both apprehension about surgery and overall mental health, and the age of the patient.

While the success of surgery is influenced by individual patient factors, a successful intervention is also dependent upon matching the correct technique to the patient.³⁹ A urodynamic study is then appropriate to determine the cause of the SI as well as define the exact anatomical elements that need surgical correction.³⁸ A urodynamic study consists of a measure of the volume, pressure, and flow rate of urine in the urinary tract.³⁸ The study is vital in that it will differentiate the cause of SI, urethral displacement or bladder neck incompetence, and, therefore, provide a basis for selecting the proper surgical technique. The major benefit of the study is that it establishes whether the structures are in need of surgical repair or stabilization or whether other methods will bring relief. The information allows the patient to make an informed decision which is very important as any surgery should never be rushed.

The surgeries that rectify SI are many. However, only a brief overview will be described. The four major types of surgical procedures are retropubic suspensions, transvaginal suspensions, sling repairs, and anterior repairs.³⁷ These types constitute families or groupings of surgeries, and each family is comprised of several distinct techniques pioneered by different individuals.

For the sake of establishing a familiarity with and a distinction between the different families of surgeries, a few will be discussed. Two main types of retropubic suspension operations are the Marshall-Marchetti-Krants (MMK, for ease) and the Burch procedure.³⁸ The MMK operation attaches the urethra to the posterior pubic symphysis, while the Burch attaches the bladder neck to the vaginal wall.³⁵ The suspension operations, therefore, fixate the urethra preventing any excess movement. The MMK operation is associated with an 88.7% success rate; the Burch 94.1%.³⁹ Another family of surgical procedures, the sling repairs, increase coaptation of the urethra by placing a muscular sling under the bladder neck providing support.³⁸ The suburethral sling procedure is the most impressive with a 97.5% success rate.³⁹ The Kelly procedure places tissues of the anterior vagina beneath the bladder neck providing support and elevation.³⁸ The support provided by the vaginal tissues prevents displacement of the bladder neck allowing equal transmission of the intraabdominal pressure. The Kelly procedure is associated with a 66.2% success rate.³⁹ The purpose of the transvaginal suspension technique is to restore the position of the bladder neck and urethra. A specific bone-anchor suspension that utilizes the endopelvic fascia reports a cure rate of 81.7% in 71 patients after three years.⁴¹

According to surgical groupings, retropubic suspensions and slings are the most successful in terms of long-term (48 months) cure rates.³⁷ However, these procedures are associated with slightly higher complications which has an effect on patient preference and selection of these procedures. For those who desire a lower risk of complications, transvaginal suspensions and anterior repairs are more appropriate.³⁷ However, the transvaginal suspensions and anterior repairs are associated with a decreased success rate when compared to the retropubic and sling procedures. The Kelly procedure is often preferred for its low morbidity and short duration of operation, yet it has the lowest success rate (66.2%) among surgeries examined here.³⁹

There are numerous advantages to surgical intervention. The various surgical techniques have been shown to be successful, although the outcomes vary. Surgical treatment of SI is effective, offering a long-term solution for many women. Surgery can be regarded as a savior because it often eliminates a problem that other methods have been unable to cure. Finally, with the continued evolution of technology, less evasive techniques, therefore less risk of complications, are continually perfected.³⁸

There are many disadvantages associated with surgical interventions. Perhaps the most significant, in an era of rapidly escalating medical costs, is the cost of surgery itself. Ironically, the cost of surgery and the need for surgery could, in most cases, have been prevented with earlier interventions and the use of behavioral techniques that will be discussed later. Other disadvantages have to do with the intangibles associated with surgery. Death as a complication of

surgery is so rare that in most literature it is not even mentioned.³⁷ Though complications are low, the thought of anything happening during the surgery is enough to dissuade those who have an aversion to surgery and/or hospitals.

Pharmacological

Treatment of SI with various pharmacological agents is generally considered to be the second line of defense against the symptoms of SI. Medication should be used to treat those who do not sufficiently respond to behavioral therapy and before surgical interventions are considered.⁴² Therefore, mild to moderate SI symptoms are an indication for the use of various medications. Pharmacologic agents are intended to increase the outlet resistance of the urethra and the bladder neck.⁸

A high concentration of alpha-adrenergic receptors are located throughout the bladder neck and proximal urethra.^{42,43} As previously alluded, the goal of pharmacologic therapy is to increase outlet resistance. Therefore, the success of pharmacologic therapy is dependent on the selection of medications that affect the alpha-adrenergic receptors.⁸ The alpha-adrenergic agonists increase outlet resistance by increasing tone in the bladder neck and proximal urethra and by increasing coaptation of the urethral surface.^{42,43} Phenylpropanolamine (PPA) specifically is considered the first choice in pharmacologic therapy.⁸ Studies show that 31% to 60% of patients treated with PPA exhibited a decrease in symptoms of incontinence as compared to a placebo group.⁸ However, the same group of studies illustrated that none of the women in the study were cured of their incontinence. However, Goode and Burgio⁴² report that in seven studies

of PPA in SI women, 19% to 60% experienced a reduction in symptoms while 0% to 14% became dry. While some discrepancy exists in the literature about the efficacy of PPA in curing incontinence, it is clear that PPA has a remarkable effect on limiting symptoms. PPA is generally administered orally three times per day.⁴³ Alpha-adrenergic agonists continue to be utilized as a treatment for SI despite various side effects that will be discussed shortly.

Estrogen is utilized with the goal of restoring urethral mucosal coaptation, increasing muscle tone, and increasing the alpha-adrenergic response.^{8,42} As explained earlier, the lack of estrogen has devastating consequences on the urethra itself as well as the support network of the pelvic floor. Therefore, estrogen may be utilized as the initial pharmacological agent in the treatment of SI.²⁷ There are a variety of methods for the administration of estrogen into the body. Estrogen may be taken orally, transdermally, transvaginally, or intramuscularly.²⁷

The efficacy of estrogen in the treatment of UI is a highly contested issue. Goode and Burgio⁴² report that 0% to 14% of patients treated with estrogen become dry, and 29% to 89% show a decrease in the symptoms of incontinence. The improvement rate is similar to the 31% to 60% reported for the alpha-adrenergic agonist PPA. Similarly, Sartori et al⁴⁴ report that 46% of patients treated with estrogen were cured; that is, had no complaints of wetness, while 43% reported being markedly improved. The Sartori study examined 37 postmenopausal women with SI, and all were given daily doses of estrogen for three months. Seven dropped out of the study, so the data reflect the

percentages improved from 30 patients. The findings of other researchers have put the question of estrogen efficacy in doubt. The study by Fantl et al⁴⁵ examined 83 postmenopausal women who were given conjugated estrogen for three months and compared the results to a placebo group. The study found that no significant changes were evident in the number of incontinent episodes after three months of treatment. Similarly, a study by Sultana and Walters⁴⁶ did not support estrogen replacement as a therapy for SI, stating that it may be more useful in treating urge and frequency incontinence.

One main disadvantage to pharmacologic treatment, specifically estrogen therapy, is the ambiguity of the literature toward its efficacy. Another disadvantage to the use of medications is the side effects that can accompany them. Side effects of the alpha agonists include dry mouth, bitter taste, insomnia, elevated blood pressure, and arrhythmias.^{27,42} PPA in particular is contraindicated in those with hypertension.⁸ Side effects of estrogen therapy include breast discomfort and enlargement and genital bleeding.⁴⁴ Contraindications for estrogen therapy include cancer of the breast, cervix, or uterus or the presence of active thromboembolic disorders.⁴² For many women who have a contraindication or who cannot tolerate the side effects, pharmacologic treatment is ineffective. Due to the disputed results, side effects, and the cost of the medication, pharmacotherapy should only be utilized in the appropriate population. This may include those who have no contraindications or have poor results with behavioral therapy.

Behavioral Therapy

Behavioral techniques are considered to be the first choice in treatment of mild cases of SI. If behavioral interventions fail, the patient then turns to pharmacologic and finally surgical remedies. Behavioral techniques are popular for many reasons. An attractive aspect to many women is that these techniques have no side effects.⁸ There is no associated nausea and no drug interactions with which the individual must concern herself as there are no medications used. Behavioral techniques are associated with the lowest risk of any of the previously discussed treatment options.¹⁰ Behavioral techniques are also very cost effective as they are primarily concerned with altering patient behavior. The most important benefit is the preventative aspect in that exercises, if initiated soon enough in women with mild incontinence, can be curative, thus circumventing the need for medications and surgery.

Behavioral techniques can be individualized into caregiver dependent activities and activities that require the active participation of the patient. Examples of caregiver dependent activities, commonly utilized with individuals with cognitive deficits, are toilet assistance and bladder retraining.¹⁰ Techniques that require active patient participation are known as pelvic muscle exercises or, more commonly, Kegel's exercises.⁸

Arnold H. Kegel developed the concept of pelvic floor exercises in 1948.¹⁷ He recognized the importance that a healthy pubococcygeus muscle has on maintaining continence. Kegel utilized a perineometer inserted into the vagina to measure the force of contraction of the pubococcygeus muscle.⁴³ Kegel⁴⁷ reports

that in women with no signs of incontinence, the reading of the perineometer will be 30 to 60 mmHg; while in patients with SI, the reading will be 0 to 5 mmHg. Therefore, Kegel developed the pelvic floor exercises that have since become an integral treatment for women with SI.¹⁷

To perform Kegel's exercises, women must be properly informed on how to complete them. Initially, the first step involves inserting a finger or two inside the vagina and contracting as if to stop the flow of urine.^{30,36} The insertion of the fingers is important initially to help the woman feel the contraction of the muscle and is not a necessary component that has to be performed with each repetition of the exercise. Often, the woman will be in a supine position at first for comfort. It is important to limit the contraction of the abdominal, gluteal, and thigh musculature.^{8,36} Techniques to facilitate the isolated contraction of the levator ani will be discussed shortly. The sensation associated with a proper pelvic floor contraction can be described as a feeling of drawing the pelvic floor up and in. It is important initially not to overdo the exercises as spasms can result. The number of repetitions and sets varies by patient. Sets of five reps, ten sets daily, ten repetitions for three sets a day, 30 to 80 repetitions a day all the way to 300 contractions a day are recommended.^{8,30,47} Each contraction should be held for approximately ten seconds, with ten seconds rest between contractions. As the patient becomes more efficient at performing the exercises, she can begin to perform them in positions other than supine at anytime throughout the day. To further progress the exercises, the patient may utilize vaginal cones.³⁰ Vaginal cones are weights that come in a variety of sizes and are inserted into the

vagina. The goal with the cones is to increase the muscle strength by the patient concentrating on maintaining the position of the weight as she performs various activities. The progression of exercises from supine to performing activities with vaginal cones progressively strengthens the levator ani.

It was stated in Chapter III that the levator ani is composed of both fast twitch (type II) and slow twitch (type I) muscle fibers. Therefore, it is important to train both types when performing Kegel's exercises. The sustained ten-second contractions will facilitate the strengthening of the fatigue resistant type I fibers. A series of fast contractions at the end of each prolonged contraction will induce hypertrophy of the type II fibers.

The effect that Kegel's exercises has on improving continence is well documented in the literature. Of women who perform pelvic floor exercises, estimates are as high as 75% to 80% for showing improvement after eight weeks.^{33,36} Kegel himself reported complete relief of symptoms in 84% of women.⁴⁷ While slightly lower, Dougherty et al⁴⁸ reported a 62% reduction in symptoms from their study of 65 women from 35 to 37 years old. Clearly, Kegel's exercises have been shown to greatly reduce the symptoms of SI.

There are a few major disadvantages associated with Kegel's exercises. The first is that the exercises are only beneficial if the patient performs them. In order to show improvement, Kegel's must be performed from eight weeks⁸ to six months.^{8,30} Often, women are concerned that they are not doing the exercises correctly, get discouraged, and discontinue the exercises. The second disadvantage is that many women have significant trouble isolating the levator

ani muscle from the abdominals and gluteal musculature. Fortunately, these disadvantages are easily correctable.

Biofeedback devices are often utilized to help the patient gain functional control over the levator ani.⁸ Biofeedback, either audio or visual, is a method for patients to demonstrate increased control of and isolation over the contraction or relaxation of the levator ani. A probe (perineometer) is placed in the vagina and the contraction is registered on the biofeedback unit.³⁶ The auditory or visual feedback, depending upon the type of machine utilized, will facilitate understanding of how a correct contraction feels. Electrodes can also be attached to the musculature from which the patient has to isolate the levator ani, such as the abdominal musculature. It is through the use of this multi-channel feedback that the patient can gain control over the agonist (levator ani) while inhibiting the antagonist (abdominals, gluts).¹⁷ Through the use of biofeedback, the patient gains sensory awareness as to the proper technique to be utilized. Kegel⁴⁷ reported that muscular education was increased when the patient could in some way visually observe the effort.

When properly utilized, biofeedback increases the success of Kegel's exercises.³⁶ The use of the perineometer helps the patient identify the muscle and provides immediate constructive support in response to a correct contraction. In weight training, if the lifter excessively rocks backwards while performing a biceps curl in the standing position, the exertion is inefficient at best and definitely not specific to the biceps muscles. If, however, the lifter minimizes the inefficient movement and concentrates on the steady contraction of the

biceps, the exercise is suddenly very specific. The same principle of specificity applies to the levator ani. If the patient can focus specifically on the levator ani and inhibit the antagonist muscles, with the help of biofeedback, the contraction will be much more effective and strengthening will occur as a result of the specificity of the contraction. Studies of biofeedback in conjunction with pelvic exercise report a 54% to 87% improvement in incontinence.⁸ Burgio et al⁴⁹ found that 13 subjects receiving biofeedback reduced the occurrence of incontinent episodes by 75.9% compared with a 51% reduction of episodes in 11 subjects who performed pelvic floor exercises without biofeedback.

Pelvic floor therapy is a noninvasive, low risk option and should be considered the first line of treatment for mild cases of SI.¹⁷ Kegel's exercises have the advantage that they can easily be done anytime, anywhere. In terms of cost in time and money, reeducation of the pelvic floor muscles is one of the simplest methods of regaining bladder control for those with mild SI.⁴³ This chapter reviewed the various options from which a woman suffering from SI has to choose, based on severity of symptoms. The Snyder and Lipsitz scale for measuring the severity of SI referred to in the last chapter provides an accurate assessment tool. With mild to moderate severity, conservative therapy is often the best treatment option. Pelvic floor exercises, when the patient is compliant and performs them, have at least equal efficacy and often a greater chance of improving symptoms than the more expensive and invasive options of pharmacologic and surgical interventions.

CHAPTER VI

CONCLUSION

Urinary incontinence is a problematic condition that affects an estimated 13 million Americans. Elderly women are primarily afflicted with symptoms of UI. Of the four major categories of incontinence, stress, urge, overflow, and mixed, stress incontinence comprises the largest percentage of reported cases. The primary reasons for stress incontinence in elderly women are the physiological and anatomical changes associated with menopause and parity.

While the economic cost of urinary incontinence management is in the millions, it pales in comparison to the psychological costs. Women often completely change their lifestyles in ways specifically designed to avoid an embarrassing accident. The lack of social contact and cessation of pleasurable activities is a source for loss of self esteem and depression.

Fortunately, UI can be treated. Treatment options include surgical repair of damaged structures, pharmacologic therapy to manage symptoms, and behavioral therapy. Surgical and pharmacologic interventions are generally indicated for more severe cases of incontinence. However, these methods are often very expensive and can be associated with negative side effects.

Behavioral therapy is indicated for mild to moderate cases of incontinence. The goal is for the patient to modify behavior to decrease

symptoms, thus circumventing the need for surgery and medications in the future. There are a variety of techniques available, from keeping a bladder diary to modifying dietary items, such as caffeine and chocolate. Kegel's exercises have been shown to be an effective behavioral therapy. The efficacy is increased when used in conjunction with biofeedback which provides positive reinforcement to the patient that she is performing the exercises correctly. Modifying behavior early is the key to preventing the progression of incontinence. The behavior techniques are generally simple, do not require much time to perform, and are inexpensive. If begun early, the behavioral therapy effectively decreases the symptoms of incontinence. More research is needed to quantify results and establish the best method of conservative treatment for UI. The information would be integral to satisfy third party payers and facilitate the implementation of behavior modification techniques to more women. Ideally, the results of these actions will be a decrease in the prevalence of urinary incontinence.

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